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Evaluating Proposed Improvements of Public Rangelands

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RESEARCH SUMMARY

Concepts and processes for economic analysis of a rangeland development project are discussed. Various approaches to estimating the value of animal unit months of grazing use may be used. The actual method employed will depend on the analysis being performed and the availability of economic information. If the three major types of estimates are available the preferred value would be from production studies.

Ultimately, analysis results are to be used by forest supervisors, district managers, range managers, or others who must determine the use of and weight given to economic information. Such information may be a critical part of the decision or secondary consideration.

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INTRODUCTION

Those who manage public rangelands are showing increased interest in formal economic evaluations of proposed improvement projects. First, Federal laws, such as the National Environmental Policy Act (1969), National Forest Management Act (1976), and Federal Land Policy and Management Act (1976) mandate such analyses as part of management planning. Second, the Office of Management and Budget (1972) requires formal evaluation and ranking of alternative proposals. Finally, severely limited budgets dictate that rangeland improvement projects be carefully evaluated, largely in terms of economic efficiency, and only those that are most efficient be funded. Although economics will not be the sole criterion for selecting projects, more weight is given this factor than in the past.

Both the U.S. Department of Agriculture, Forest Service and the U.S. Department of the Interior, Bureau of Land Management are developing specific guidelines for implementing the requirements broadly stated in the public laws (Federal Register 1981). The purpose of this report, therefore, is to outline a general procedure for conducting a comprehensive economic evaluation of proposed improvements and to review some basic principles of range economics.

OBJECTIVES AND CRITERIA

Economic analysis should be used to provide information to be tested against economic objectives or decision criteria; for example, a specific rate of return or level of net income. So doing, one could see whether proper amounts of relevant data were collected and included in the analysis, and if proper analytical procedures were used.

Specific requirements should be agreed upon by decisionmakers and analysts before analysis begins so that only relevant economic information will be generated. For example, if a decision criterion states that only those projects yielding a net annual return of over 8 percent will be considered for funding, the analyst should determine rates of return for each project. Too often objectives and decision criteria for both the planning and management of a rangeland area are anything but clearly understood. Broad goals may be easier to develop initially, but do not lead to systematically developed plans specific enough for quantitative analysis. Unclear decision criteria often lead to confusion for the analyst, the decisionmaker, and the public.

ECONOMIC ANALYSIS TECHNIQUES

When trying to determine economic effects of range projects through the application of proven techniques (Bartlett and Ralphs 1978; Young 1979), the analyst must generate accurate estimates of the economic value of range forage. Numerous evaluation techniques have been developed and tested over the past two decades (McCorkle 1959; Cook 1979; Young 1979). The choice of technique depends largely upon how the analysis is to be used and what economic information is needed. For example, an analysis of cash flow usually differs from a profit-loss analysis, and a benefit-cost analysis may differ from both. Agency budget and receipts accounting procedures yield different results than complete benefit-cost analysis.

The Bureau of Land Management and the Forest Service have recently strengthened economic analysis procedures (Federal Register 1981) to provide concise, logical, and consistent guidelines for treatment of costs for and benefits of range projects. The lack of complete accounting for costs and benefits causes problems when ranking proposed projects by comparing one to another because those left out may be important in one project and negligible in another. If projects are to be tested against a standard (such as fixed rate of return), it is very important to fully measure the total economic effects so that worthy projects can be included in agency programs.

BASIC CONCEPTS

Regardless of the technique used to estimate unit values of forage and other range outputs, it seems reasonable to expect all benefits and costs to be included. A simple model would follow the form $TNB = T_B - T_C$ where TNB = total net benefits, T_B = total benefits, and T_C = total costs.

In this general form there is no differentiation between private and public costs and benefits. A further breakdown of the general model would be $T_C = P_C + PVT_C$ where T_C = total project costs, P_C = public costs, and PVT_C = private costs.

The costs would include all costs directly attributable to producing and using the new forage. Benefits could, likewise, be looked at as a composite of the public and private sectors.

Rangeland managers need to consider all relevant costs and benefits. Public land managers can properly base decisions on a broader spectrum of costs and benefits than the private landowners, whose main criteria are net profits or cash flows from livestock sales. The values of watershed protection, wildlife, and other public values not fully measured in market terms have greater relevance to public managers as decision criteria.

To provide a basic comparison, the future situation for conditions "with" and "without" the proposal should be estimated. In other words, the costs and benefits for the expected life of the proposal should be estimated. For example, if the future held a substantial reduction in grazing without the development, and the development scenario maintained current livestock numbers, the difference would be the effect attributable to the project. Put in simple arithmetical form: Net Project AUMs = W – WO, where W = with project, WO = without project, and AUM = animal unit month.

This comparison of the project to doing nothing is only one comparison that needs to be made before one can be certain

the project or design is the best. Best is defined as the project which would yield the largest level of net benefits (TNB or $T_B - T_C$).

In considering future benefits and costs, the problem involved with differing time frames must be taken into account. Many projects involve expenditures of funds for treatments and facilities at the beginning and do not show benefits for a period of years. This situation is commonly solved by use of a procedure called discounting where future values are reduced to show time preference. In short, future values are not given full par value with current values.

To make discounting possible an interest rate or discount rate reflecting the preference for current values over future ones must be selected. Public agencies use rates prescribed by the Water Resource Council or the Office of Management and Budget. Currently these rates are less than private money market rates. Analysts for the public agencies are not free to choose interest rates and are directed to apply the prescribed rate to all projects. This procedure leads to some degree of consistency so that project ranking can be accomplished.

Because a primary purpose of range development programs is to produce livestock forage, determining the value of forage is a critical element. There are numerous variations of three main methods for estimating forage value (Roberts and Wennergren 1963; Bartlett and Ralphs 1978). Studies using these methods could be grouped under the following categories: (1) comparisons with market-priced forages and feed sources, (2) capitalization of permit values, and (3) production analysis. Each of the methods makes different assumptions and has different data requirements. All approaches are theoretically compatible and should yield similar results if accurate data are available and the inherent assumptions are met.

Some authorities have argued for using grazing fees as the proxy for project benefits. This would be consistent with economic principles if the fee truly represented the net economic benefit or value of the forage to society. For public land grazing, the existence of the permit value substantiates the argument that Federal grazing fees do not generally represent the marginal value product of the forage (Gardner 1962; Roberts 1963; Martin and Jefferies 1965; Nielson and Roberts 1968). Using the fee as the net value of the forage would underestimate its value to the range user and the general economy (Andrus and Berglund 1977).

Where public rangeland projects are being analyzed, the most logical approach would appear to be counting all direct benefits and costs regardless of fee structures, which are based on noneconomic factors. This also needs to be done independently of agency budgeting and accounting guides, which preclude certain values (Byington and Child 1979). Not including some values for either the costs or benefits will result in biased conclusions.

Direct market comparisons are widely used to estimate unit values of goods where a market exists. Range forage is exchanged between individuals, so the primary criterion for a market is satisfied. Forage markets are largely local and informal, but one can usually determine the exchange prices for forage in a local area (Andrus and Berglund 1977). The values for rangeland use thus derived generally include items other than the forage, such as water, salt or minerals, herding, and fence maintenance. Those nonforage items need to be subtracted from the lease amount so that comparisons include only the forage. To be most accurate the ranges should be as similar as possible in terms of topography, forage, water, season of use, and location. The market comparison approach has the advantage of using current information about what actually transpires between range forage buyers and sellers. It rests on the concept that all units of a product should have an equal market price under competitive market conditions. Therefore, additional units of a given type of forage could be expected to have a value equal to those traded in the market.

Another economic principle of competitive markets is that substitutes should be of equal value. For example, high quality range forage and harvested roughage or irrigated pasture are technical substitutes for livestock production. There have been several attempts to place a value on range forage by comparing the values of substitutes. Various substitute feeds such as hay, concentrates, and field aftermath have been used in numerous studies (Roberts and Wennergren 1963). The problem with this approach is determining whether these actually are economic substitutes for range forage (Bartlett and Ralphs 1978). Is the substitute feed physically available and would it be technically possible to use it to substitute for range forage on a sustained basis? Feeding concentrates may make a good deal of sense during an unusually stormy period, but be entirely prohibitive as a standard procedure every year. Nevertheless, this approach can be used to give estimates of range forage values.

An almost limitless variety of ranch budgeting techniques have been used to estimate forage values (Roberts and Gee 1963; Nielson 1977; Gee 1981). Methods range from complex computerized models of entire operations to partial budgets using a few factors. Budgeting relies on accurate assignment of costs and returns to the factors of production. The major assumption of the budget method is the idea of obtaining a residual value where all factors other than one (forage in our case) have received their proper allocation of revenue. Any residual of revenue is then attributed to the forage and is used as an estimate of its value.

The budget approach can use actual data from rancher's records or synthetic data generated for a typical or model ranch or data from secondary sources. Each of the three methods would yield a similar value if perfect data were available and all assumptions met. In practice, there are differences and the choice of which value to use has not been consistent.

ESTIMATING PROJECT COSTS

Beginning with the cost side of the ledger, one would want to determine the cost for various project purposes. There would be investment costs for installation of the project, nonuse costs, maintenance costs, and yearly operational costs. These costs may be a mixture of public and private or all one or the other.

There is a question as to whether planning costs should be included as project costs. A reasonable approach seems to be inclusion of those design and layout costs incurred after a decision to proceed with project planning has been made and which would not be incurred if the project were dropped. General inventory and program level planning costs seem more appropriately to be part of the general overhead.

Initial investment must consider opportunity costs, which is the value of net returns foregone from the best alternative precluded by the project. For example, trees might be burned to increase forage production. If burned, the trees obviously cannot be used for fuelwood. If the rate of return from the increased forage produced by burning is less than the rate of return from fuelwood, net benefits would be increased by using

trees for fuelwood. The concept of opportunity costs sets the lower boundary that project benefits must exceed to be feasible (Lloyd and Cook 1960). If the proposal does not yield a rate of return that exceeds that of an alternative use of the funds, the proposal should not be chosen from a purely economic efficiency viewpoint because superior economic returns are available elsewhere.

To use additional forage, additional expenditures for production items directly related to the project, such as herding, fence maintenance, salting winter feed, and medicine may be needed. Also, the level of capital investment and total operation costs may be increased if the scale of operation is changed (Nielson and Hinkley 1975). These costs are often overlooked in analysis of range projects, thus understating the total costs. To the rancher, these costs are very important because they affect ranch income and may also have an impact on the ranch's financial condition.

ESTIMATING PROJECT BENEFITS

Like costs, rangeland development benefits come in various forms, varying from increased forage to greater watershed stability. It seems logical to count all project benefits regardless of location or who receives them and irrespective of whether a user fee is charged.

Because all rangeland areas are also used for purposes other than livestock grazing, it is important to recognize these uses when formulating plans. Very often range development projects will be changed from the alternative that maximizes livestock use of forage to accommodate other uses.

Many rangeland goods or products are not traded in formal markets and are difficult to evaluate in economic terms. Economists have struggled with placing values on nonmarket items for decades and have not developed entirely suitable methods. Perhaps the best that can be done is to quantify these project effects in terms of species, numbers, cost per unit, or other terms. This would make comparisons among alternatives, including foregoing the project, meaningful enough to reveal physical and economic differences.

For purposes of developing a realistic model for economic analysis, all uses and outputs for a rangeland area need to be included. It is expected that some uses on some areas will be insignificant or small enough to preclude accurate measure. In such cases, the magnitude should be noted so a record of consideration and reasons for noninclusion is made.

SUGGESTED EVALUATION CHECKLIST

A. General
   1. Goals and specific management objectives for planning and management
   2. Economic decision criteria to be used in selecting proposed alternatives

B. Range livestock
   1. Class of livestock
   2. Season of use
   3. Integration of project forage into total livestock operation
   4. Value of forage (by one or more methods)
   5. Project costs (public and private)
      a. Development
      b. Maintenance
      c. Management
   6. Secondary economic impacts due to increased ranch income and project induced spending

C. Wildlife
   1. Kinds impacted by project
   2. Population changes due to project
   3. Uses of wildlife populations
      a. Consumptive
      b. Nonconsumptive
   4. Wildlife-related project costs
      a. Direct
      b. Associated

D. Watershed
   1. Water yield
   2. Time of release
   3. Quality changes
   4. Use made of water
   5. Unit values
      a. Benefits
   6. Watershed costs
      a. Direct
      b. Associated (costs associated with water use; treatment, conveyance, etc.)

E. Recreation
   1. Type of use
   2. Level of use
   3. Cost
      a. Direct
      b. Associated

F. Timber or fuelwood
   1. Type of product
   2. Unit value
   3. Change in quantity related to project
   4. Costs
      a. Direct
      b. Associated

G. Miscellaneous land uses
   1. Type of use
   2. Value of use

SUMMARY

The preceding discussion outlines concepts and processes for economic analysis of a rangeland development project. Various approaches to estimating the value of AUM's may be used. The actual method employed will depend on the analysis being performed and the availability of economic information. If all three types are available the preferred value would be those from production studies.

Ultimately, analysis results are to be used by forest supervisors, district managers, ranch managers, or others who must determine the use of and weight given to economic information. Such information may be a critical part of the decision or secondary consideration.

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Basic economic concepts and analysis processes relevant to analysis of proposed range improvement projects are presented. These matters are of concern because increasing pressure for more consideration of the economics of public programs are being felt by land managers and administration. A checklist of factors to be considered in completing an analysis is included.

KEYWORDS: range economics, rangeland improvement economics, economic analysis

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